NAVSEADET RASO COMMENTS ON
DRAFT "LOW LEVEL RADIOLOGICAL WASTE EVALUATION
ASSOCIATED WITH VARIOUS BASE REALIGNMENT AND CLOSURE ACTIVITIES"
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These comments are provided on the subject paper which was issued as the result of "an evaluation of practices currently applied at Base Realignment and Closure (BRAC) cleanup sites involved in the characterization, classification, and disposal of soil and debris containing Radium-226 (Ra-226) as low level radiological waste (LLRW)." The evaluation was contracted through Naval Facilities Engineering Command, Southwest Division (NAVFAC SW) for BRAC Project Management Office (BRAC PMO).

It should be noted, that although the paper states the evaluation applied to BRAC cleanup sites with Ra-226 LLRW, the evaluation focused on the LLRW generation and disposal practices at Hunters Point Shipyard (HPS). The representatives from Argonne National Laboratory (ANL) met with Navy (BRAC, NAVFAC SW, Naval Facilities Engineering Support Center (NFESC)) and contractor representatives to understand the characterization and decision-making processes at HPS. Other than one conference call at the start of the evaluation process, the ANL representatives did not meet with or receive input from RASO.

Although the report states that the data sets analyzed in the evaluation were from the sanitary sewer remediation, data sets from other remedial actions at HPS were included. The remediation and screening processes for the sanitary sewers and the other sites were similar; however the intent of the sewer removal and screening process is to obtain radiological release of the trench for unrestricted use and clearance of the excavated soils for use as clean backfill.

The following describes the processes at HPS for clearance of the excavated soils at HPS. This varies from the processes described in the evaluation:

- For Ra-226, the process compares soils to a release level of 1 pCi/g above Ra-226 background levels. The release limit varies at HPS depending upon the site under investigation. For the sewer removals the release limit is

1.485 pCi/g. This release limit was established after years of negotiation between the Navy, EPA Region IX, and California Department of Public Health Environmental Management Branch (CDPH-EMB). It is currently being used at Navy sites throughout the United States. The investigation level for the soil is “background plus 3 sigma”. Cesium-137 (Cs-137) and Strontium-90 (Sr-90) are also radionuclides of concern for these sites. The release limits as approved by the EPA Region IX and CDPH-EMB are 0.113 pCi/g for Cs-137 and 0.331 pCi/g for Sr-90.

- The process evaluated was the radiological clearing of excavated soil on screening pads for unrestricted reuse. This process includes a gamma screening of the pad using a towed array, identification of systematic and biased sampling/screening locations, and, if necessary, remediation of soil above the release criteria. Prior to any sampling each of the systematic/biased sampling locations, a one minute static reading is taken with a NaI detector to confirm readings of the towed array and to compare with the sample results. The locations are then sampled with the samples processed by the on-site laboratory by gamma spectroscopy. All results are reviewed by the Lab Technician, Laboratory Manager and Project Manager. Each Ra-226 result is compared with the Bi-214 and Pb-210 results. Action with the material is taken based on sample results. Since 1 January 2011, if no action is required, the data is sent to an off-site DoD ELAP Certified laboratory for processing. If remedial action is required, a new set of 18 systematic samples are taken following remediation to confirm a clean pad for unrestricted reuse. If these samples are identified as below the release limit by the on-site lab, they are sent to the DoD ELAP Certified off-site laboratory for processing by gamma spectroscopy. Two of the 18 samples sent to the off-site laboratory are analyzed for Sr-90. The processing by the DoD ELAP Certified laboratory is a requirement for any definitive data used by the Navy to make a decision to clear property or material for unrestricted reuse. RASO reviews all laboratory data and concurs on clearance of material from the pad.

- Remediated materials are placed in bins for disposal as low-level radioactive waste (LLRW). Once the bin has been filled to the weight limit (which may include materials from multiple pads), the LLRW Contractor takes a five-point composite sample of the material in the bin. This sample

is processed by an off-site DoD ELAP Certified laboratory for the radionuclides of concern for the site where the material was removed. The analysis result of this sample is then averaged over the contents of the bin. The result does not represent the highest level of contamination in the bin and is solely used for manifesting and comparison purposes at the disposal site. Analysis results for the bin composite samples are sent to RASO for information.

The following information is provided in reference to data provided in the evaluation:

- Four different towed array systems have been used at HPS, each configured differently. RASO has reviewed the technical specifications of each system and the background data for the system prior to use. None of the systems were capable of seeing the Cs-137 release limit. Nor can the Cs-137 release limit be seen during the one-minute static reading. This issue has increased the sampling needed to clear a pad.

- Effective 1 January 2011, a new on-site laboratory was established at HPS with upgraded high-purity germanium detectors with higher efficiencies and environmental shields. This has greatly improved the performance of the on-site laboratory. The data used in the evaluation appeared to be from 2008, 2009, and 2010. RASO recognized the limitations of the previous laboratory and performed day-to-day review of data and on-site evaluations of the laboratory to ensure that all concerns were addressed.

- The process established at HPS for clearing excavated soils for unrestricted reuse as clean fill must not only meet federal and state regulatory concerns but also allow production to proceed to limit costs due to delays in field work. All work processes have been reviewed and approved by federal and state agencies, after multiple meetings and reiterations.

- The LLRW disposal is contracted through the DoD LLRW Executive Agency (U.S. Army Joint Munitions Command (JMC)) as mandated by the DoD LLRW Program/Navy LLRW Program. JMC and RASO consistently review operations and costs associated with the disposal. LLRW disposal is expensive and mixed waste disposal is more expensive and much of the waste leaving HPS is mixed waste. To compound this issue, there is a moratorium on disposal of any materials above

background radiation levels in the State of California. Consequently, if the Navy has put materials in the bin with levels above background for the radionuclide in the material, it will need to go out of California for disposal. This applies to all radionuclides of concern. Every effort is made to achieve the most cost effective disposal for the radioactive/chemical contaminants in the container. It should be noted that JMC/RASO are currently in the process of establishing a new contract for the LLRW/mixed waste disposal at HPS.

The Executive Summary of the ANL evaluation report documented the following recommendations:

1. Modify the NaI pad screening method to one that effectively identifies locations with truly elevated Ra-226 levels.

- Use pad-specific background levels to establish a gross activity investigation level.
- Confirm that flagged areas are actually elevated before proceeding with full biased samples; analyze high areas first in on-site laboratory.
- Determine the gross activity response of the NaI detector to 1 pCi/g of Ra-226 to provide a basis for investigation levels.
- Install a multichannel analyzer and make specific Ra-226 measurements on pads.

Implementing these recommendations will reduce the number of biased samples that do not find contamination and reduce overall sampling load; reduce false identification of LLRW due to analytical uncertainty in biased samples; and provide positive identification of elevated areas.

2. Implement improvements in the on-site laboratory equipment and methods to reduce the uncertainty in Ra-226 measurements and reduce the MDA to comfortably below action levels.

- Analyze Ra-226 on the basis of Bi-214, accounting for Ra-222 disequilibrium by allowing for ingrowth or by applying a correction factor.
- Install a multichannel analyzer and make specific Ra-226 measurements on pads.

Exercising this recommendation will reduce false identification of LLRW due to high relative analytical uncertainty and high bias.

3. Expand the background data set to encompass full Ra-226 variability in all soil types being remediated.

- Review existing pad data sets to identify uncontaminated pads or portions of pads; establish a large background data set from existing data that encompasses the full range of Ra-226 background.

Exercising this recommendation will reduce false identification of LLRW due to under representation of background variability.

4. Implement the 1 pCi/g on the upper end of the background data distribution rather than the mean of the distribution; retain the 2 pCi/g upper limit.

- Determine the 95th percentile of the normal distribution of a large, robust, background data set that encompasses all soil conditions; apply the 1 pCi/g Ra-226 criterion to this threshold.

Exercising this recommendation will reduce identification of LLRW for soil with natural background levels in the upper half of the background distribution.

5. Use Ra-228 levels to evaluate the actual presence of Ra-226 contamination in areas where no clearly elevated levels of Ra-226 are present.

- Determine the Ra-226/Ra-228 ratio and ratio variability in a large set of existing soil results at background levels; determine statistical threshold that shows Ra-226 clearly elevated.
- Use this ratio as part of a body of evidence for making determinations that Ra-226 is not actually present.

Exercising this recommendation will reduce false identification of LLRW through a determination that contamination is not present.

6. Modify pad sampling protocols: implement criteria as a wide-area average and related elevated area comparison values using MARSSIM principles.

- Implement pad protocols based on MARSSIM principles; select an appropriate parametric or non-parametric statistical test and design pad sampling accordingly; implement a wide area criterion and an elevated measurement comparison standard for small elevated areas.
- Continue to implement a full pad scan to identify elevated areas, but with improvements as suggested above.
- Confirm on-site laboratory results barely above cleanup levels when pads are not clearly contaminated.
- Eliminate repeat systematic sampling on pads.

Exercising this recommendation will reduce identification of LLRW by applying the Ra-226 criterion over a defined volume of

soil as an average, consistent with a risk-based approach employing defined exposure parameters; it will also reduce sampling costs and false identification of LLRW due to analytical uncertainty for single samples.

Results of RASO Review:

RASO agrees with most, if not all, of the Ra-226 background, field and analysis problems identified in the evaluation and has already documented investigations of its own into solutions to these problems plus others not identified by the evaluation. Further, some of the recommendations of this evaluation are already in practice or have been tried and dismissed due to poor results. Most of the viable recommendations will not be compatible with the regulatory environment that now exists. RASO is unable to glean any new innovative approaches from this evaluation that can be readily implemented in practice. This evaluation appears to not have recognized the complete processes that are in place or other investigations or data that led to the methodologies and conclusions that are currently in place.

RASO specific comments on the suggested improvements in the Executive Summary, as documented above, follow:

1. Extensive attempts have been made using the four towed array systems that have been used at HPS to provide a more effective identification of non-background Ra-226 levels. These have included:

- Using pad-specific or site-specific backgrounds to address unusually high NaI levels that cannot be verified by the sampling process. This was used only as a last resort as it impacts on the ability of the regulatory agencies to perform confirmatory surveys.
- Confirming the adequacy of systematic or biased sampling locations by reviewing survey data to eliminate outliers and taking static NaI surveys to verify the accuracy of the towed array.
- Determining the gross activity response of the NaI detector to 1 pCi/g of Ra-226. However, the value is low, not easily distinguishable from background, and can affect the performance of surveys for other radionuclides.
- Using multi-channel analyzers in the field to measure Ra-226 in the field and identify levels above the release criteria. This not only impacted site operations but was expensive and turned out to be inconsistent when compared with laboratory results.

None of the attempts listed above eliminated the analytical uncertainty of the previous on-site laboratory and made no difference in the amount of LLRW generated at the sites.

2. Effective 1 January 2011, a new on-site laboratory was established with all new equipment and procedures which has significantly improved the quality of the on-site laboratory data. Additionally, the final 18 samples documenting unrestricted release of a site or survey unit are sent to a DoD ELAP Certified off-site laboratory for processing. It is recognized that using the ingrowth method for analyzing Ra-226 will reduce the uncertainty. However, that requires a 21-day ingrowth time which will significantly impact on field operations. At this time all Ra-226 analysis is compared with Bi-214 and Pb-210 results to limit false positives and any questionable sample is recounted for twice the counting time. Additionally, with the final 18 going off-site, there is a comparison between the Ra-226 results by both labs that is consistently being reviewed to identify any trends that could be used to streamline the analysis process.

3. Recommendation 3 would be better applied at a different site. HPS consists primarily of fill materials from hundreds of sources and it is recognized that there is high variability of Ra-226 as well as other naturally occurring radionuclides in the soil. RASO continually works with all contractors on selection of the most appropriate background for the current work. The 0.485 background for Ra-226 was established at the start of the sewer removals. Every attempt was made to come up with a background that represented the average of the backgrounds we were seeing at HPS. Regulatory agencies wanted to see one background that could be used for all the sewers. At this point all sewers in Parcels B, D-2, and G and Utility Corridors 1, 2, and 3 as well as some sewers in Parcels D-1, C and E have been removed using this background. Individual backgrounds are considered for buildings and open areas depending on the type of materials and former uses.

4. Recommendation 4 certainly has merit but this would result in biasing the data high with no justification. As the 1 pCi/g above a mean background level has been used consistently at BRAC sites throughout the State of California, it may be difficult to get concurrence from the regulatory agencies particularly for sites like HPS where we are cleaning to residential release standards.

5. While an interesting proposal, Recommendation 5 does not appear to have any technical merit when RASO looks at the hundreds of different types of fill materials that were used to build HPS. It is recognized that the Ra-228 could be identified by analysis for Actinium-228 which is currently being performed by the on-site laboratory. However, as Ra-226 and Ra-228 are not in the same decay chain it is questionable as to their equivalence at HPS. To apply this recommendation, the Ra-226 and Ra-228 background values would need to be consistent for all the different types of fill at the site or each type of fill would need to be analyzed individually, which is not reasonable.

6. Recommendation 6 has potential however it would require a significant shift in site protocols and conflicts with current regulatory guidance from State of California regulators. At a minimum, RASO concurs on the elimination of repeat systematic sampling on pads and has previously recommended this practice for especially stubborn trenches or pads. While this would not necessarily reduce the amount of remediation, it would most likely significantly reduce the number of samples being processed.

RASO appreciates the efforts of the Mr. Kurt Picel and Mr. Robert Johnson in their evaluation of radiological operations at HPS involving Ra-226 and recognizes significant value in the conclusions and recommendations they have provided to the Navy.